# Coordinated Regional Downscaling Experiment (CORDEX)

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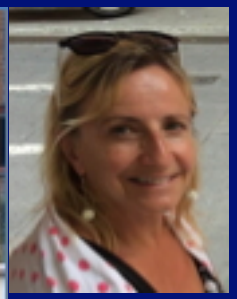

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# CORDEX Scientific Vision

*To advance and coordinate the science and application of regional climate downscaling through global partnerships*

**Goals:**

- To better understand relevant regional/local climate phenomena, their variability and changes, through downscaling.
- To evaluate and improve regional climate downscaling models and techniques
- To produce coordinated sets of regional downscaled projections worldwide
- To foster communication and knowledge exchange with users of regional climate information



WCRP CORDEX

# CORDEX – Scientific Challenges

## ✧ Added value

Internal variability & added value as functions of scale; Bias correction uncertainties and consistency; User-oriented metrics

## ✧ Human element

Coupling of regional climate and coastal megacities; Bridging with urban parameterisation development; Land use change

## ✧ Coordination of regional coupled modelling

Ocean-ice-atmosphere; Lakes; Dynamic land surface; Cryosphere; Natural fires; Atmospheric chemistry; Carbon cycle; Aerosols; Marine biogeochemistry

## ✧ Precipitation

Convective systems; Coastal storm systems; MJO/Monsoon

## ✧ Local wind systems

Wind storms; Strong regional winds; Wind energy

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17TH-20TH MAY 2016 STOCKHOLM, SWEDEN

# ICRC-CORDEX 2016


**Goal:**

Promote the CORDEX vision to advance and coordinate the science and application of regional climate downscaling through global partnerships

**Focus:**

- Analysis guided by CORDEX Science Goals.
- High resolution climate information
- Applications to VIA community and other end users

- Over 350 registered
- Special event for Early Career Scientists
- European Climate Research Alliance (ECRA) side event
- Conference report online – November 2016
- Report to appear in *Bulletin of the Am. Meteor. Society*

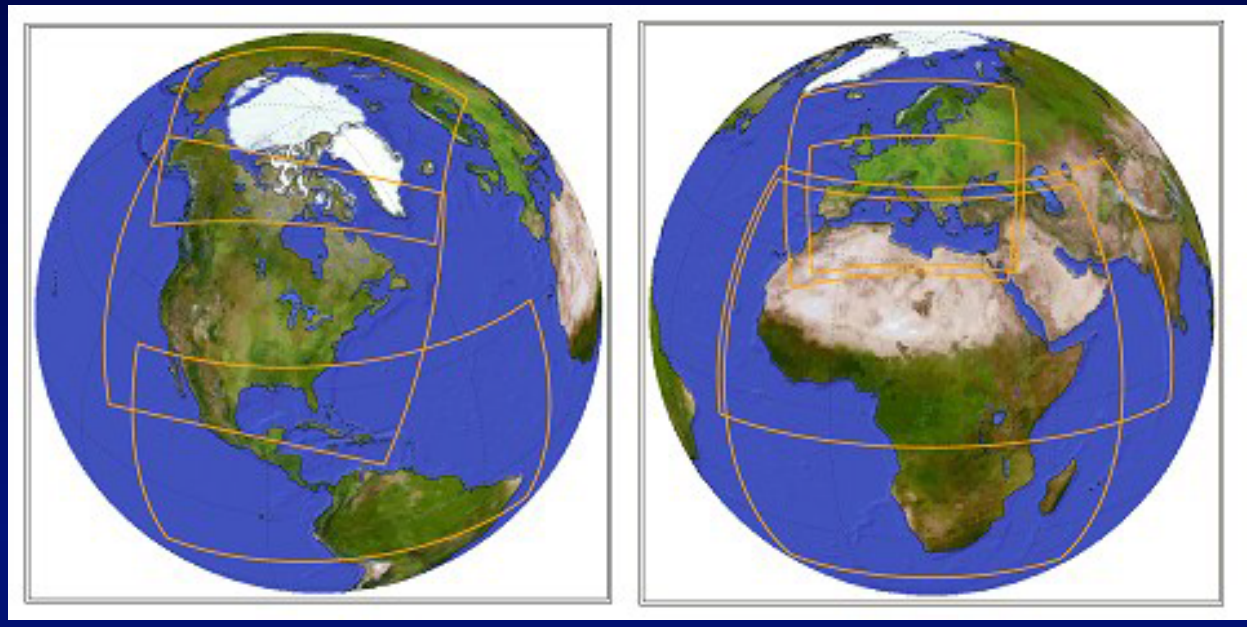
WCRP World Climate Research Programme

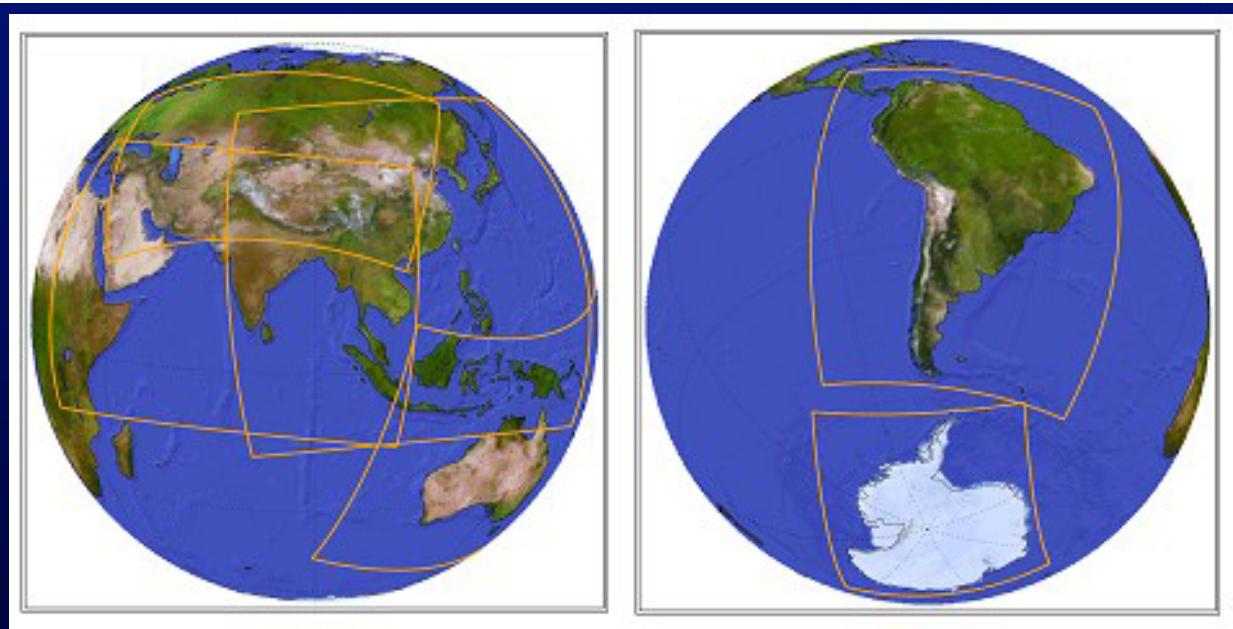
http://www.icrc-cordex2016.org/

# CORDEX Regions

**Goals:**

- Cover all major land masses + Arctic
- Build on prior experiences with regional simulations and processes



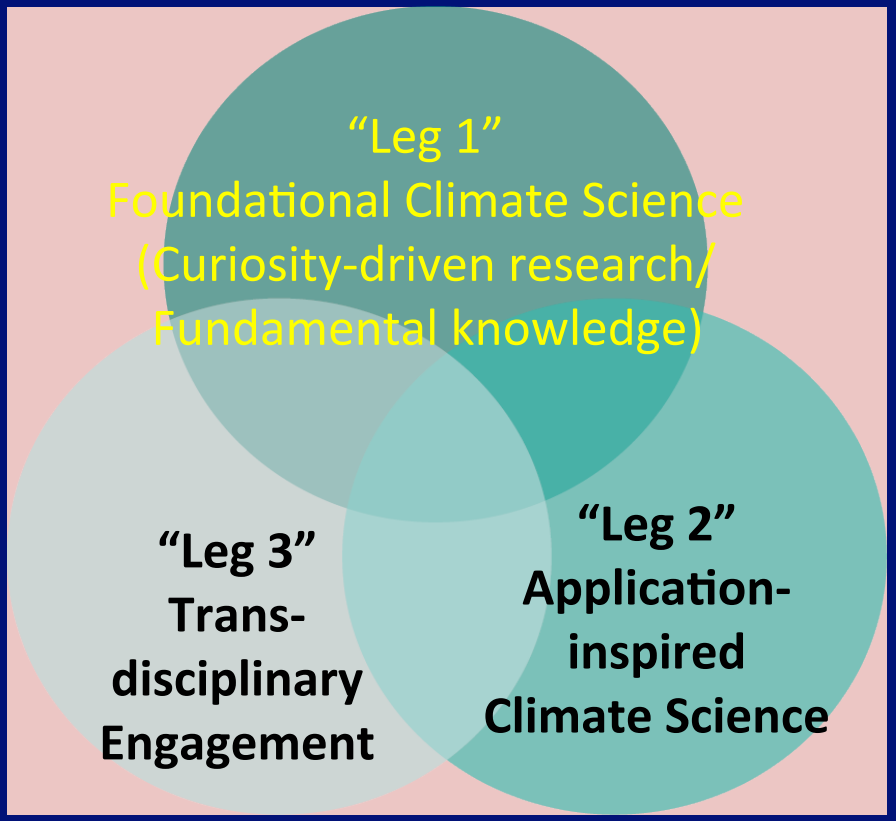


# CORDEX Workshops/Meetings

- **CORDEX Africa** Analysis workshops 3, Cape Town, February 2016
- **SEACLID/CORDEX-SEA** Progress Meeting, Jakarta, Indonesia, September 2016
- **SEACLID/CORDEX SEA** 4th Workshop, Hanoi, November 2016
- **Arctic CORDEX** meeting, Bergen, Norway November 2016
- Meeting on **Convection Permitting CORDEX FPS**, ICTP, Trieste, November 2016
- **Euro-CORDEX GA,** Hamburg, Germany, January 2017
- **CORDEX Australasia** meeting, February 2017
- Presentation of **CORDEX at CliC SSG**, Wellington, New Zealand, February 2017

# CORDEX-Related Events

- Scoping a **Framework for WCRP Regional Activities,** Hamburg, Germany, October 2016
- **CORDEX African Atlas** presentation at Cop22/UNFCCC, Marrakech, Morocco, November 2016
- Formation of **Asian ESD-CORDEX group**, Hanoi, November 2016
- Special Session at UGM, Puerto Vallarta, Mexico. SE13: Modelación Regional del Clima, Nov 2016
- 2nd Workshop on Climate Change, Variability, and Modeling over Central America and Mexico, San José, Costa Rica, November 2016
- Climate Services conference, Cape Town, February-March 2017 ➔ **Discussions with World Bank**
- WMO Workshop: Climate Services Information System Operations and Coordination, Nanjing, March 2017




➔ **Coupling with several WCRP activities**

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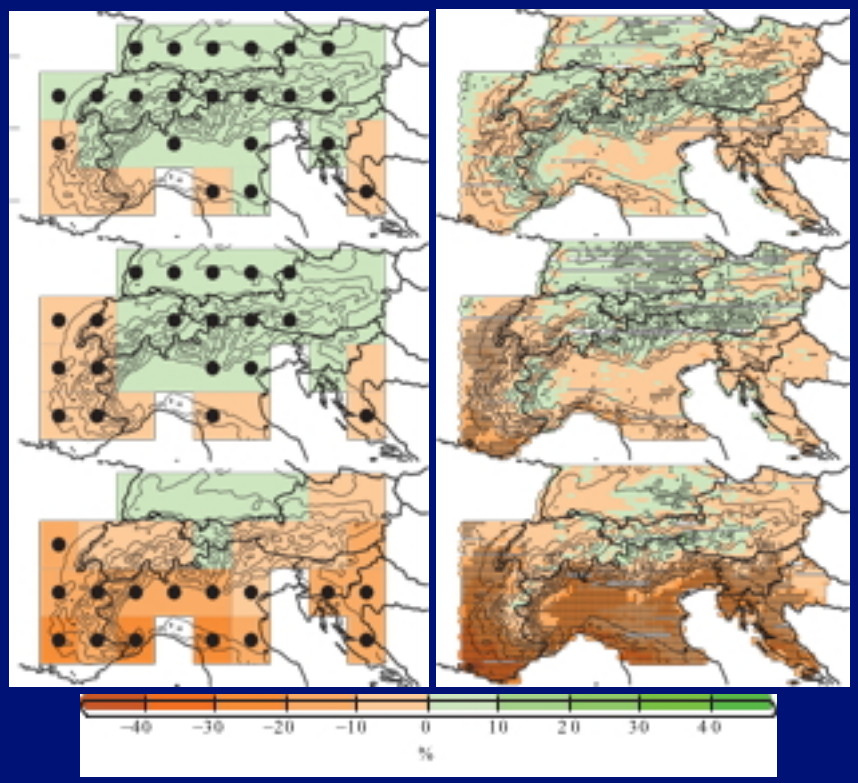
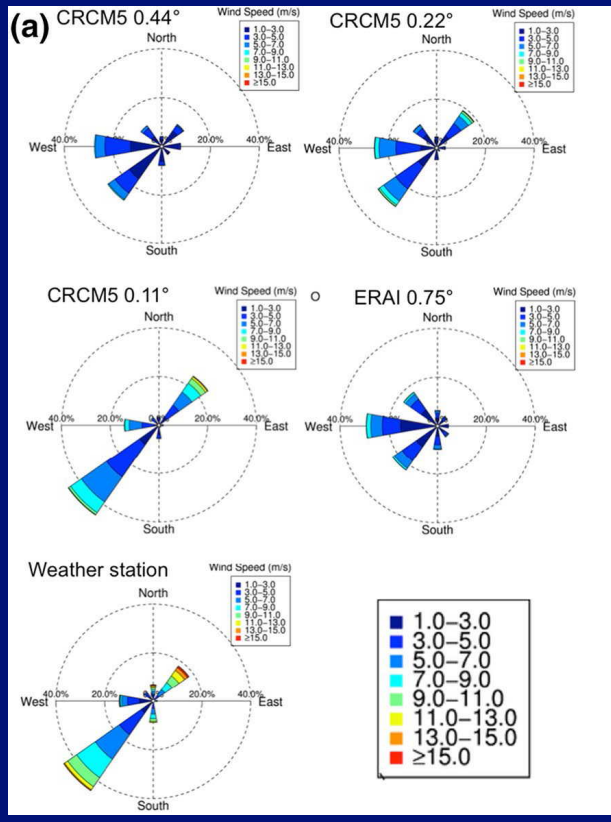
# CORDEX – Scientific Challenges

## ✧ Added value




Giorgi et al. (*Nature Geo.*, 2016) Enhanced summer convective rain at Alpine high elevations in response to climate warming.



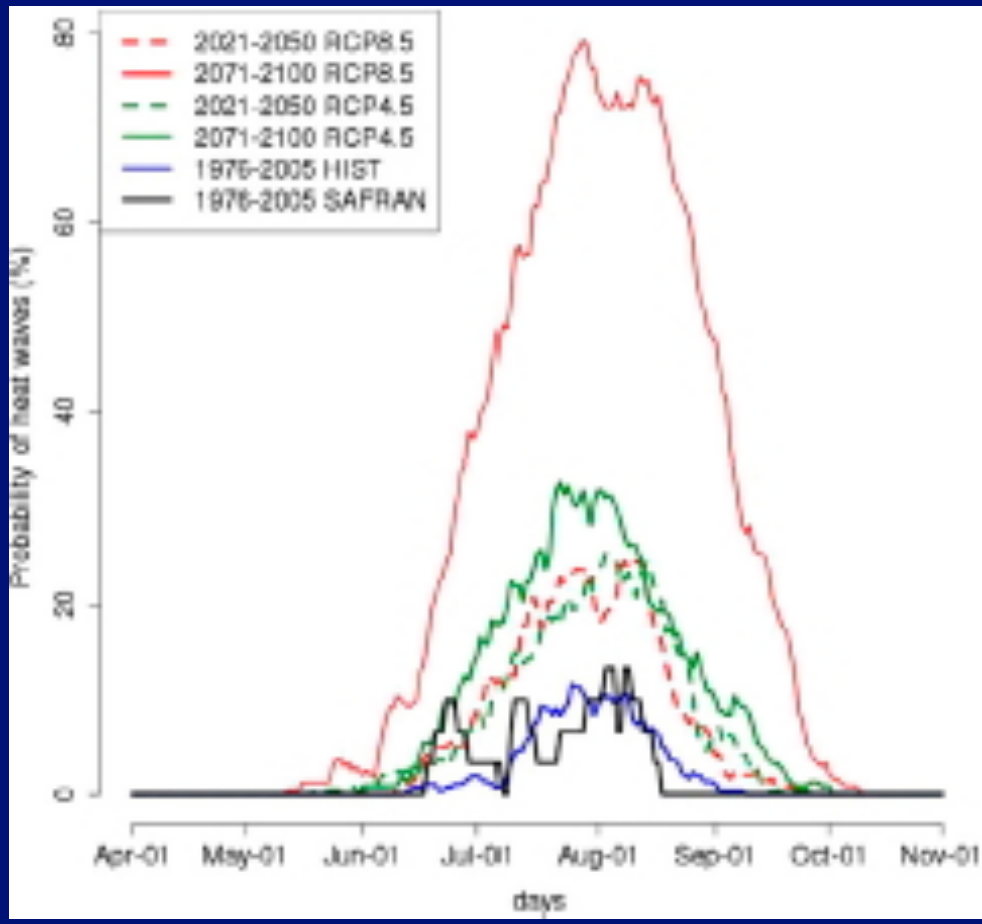

Lucas-Picher et al. (*Clim. Dyn.*, 2016) Evidence of added value in North American regional climate model hindcast simulations using ever-increasing horizontal resolutions

Di Luca et al. (*JGR-Atmos.*, 2016) Quantifying the overall added value of dynamical downscaling and the contribution from different spatial scales

# CORDEX – Scientific Challenges

- **Human element**

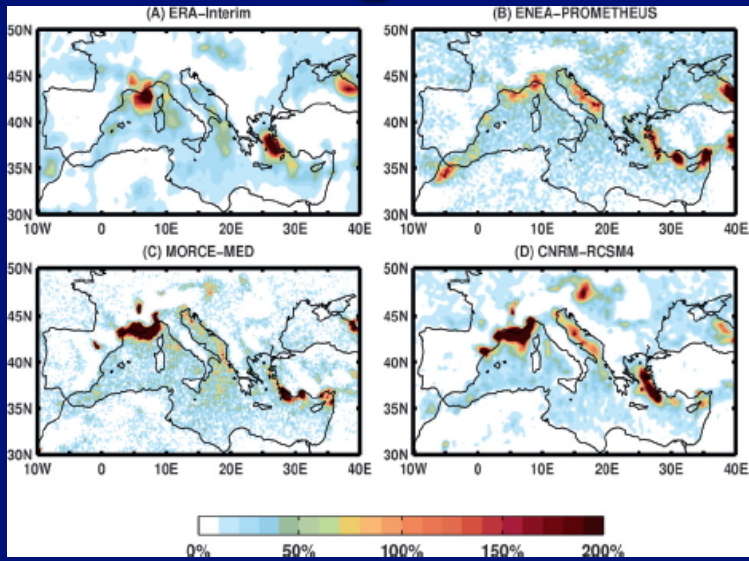
Ouzeau, G., et al. (2016). Heat waves analysis over France in present and future climate: Application of a new method on the EURO-CORDEX ensemble (2016) Climate Services, 4, pp. 1-12.



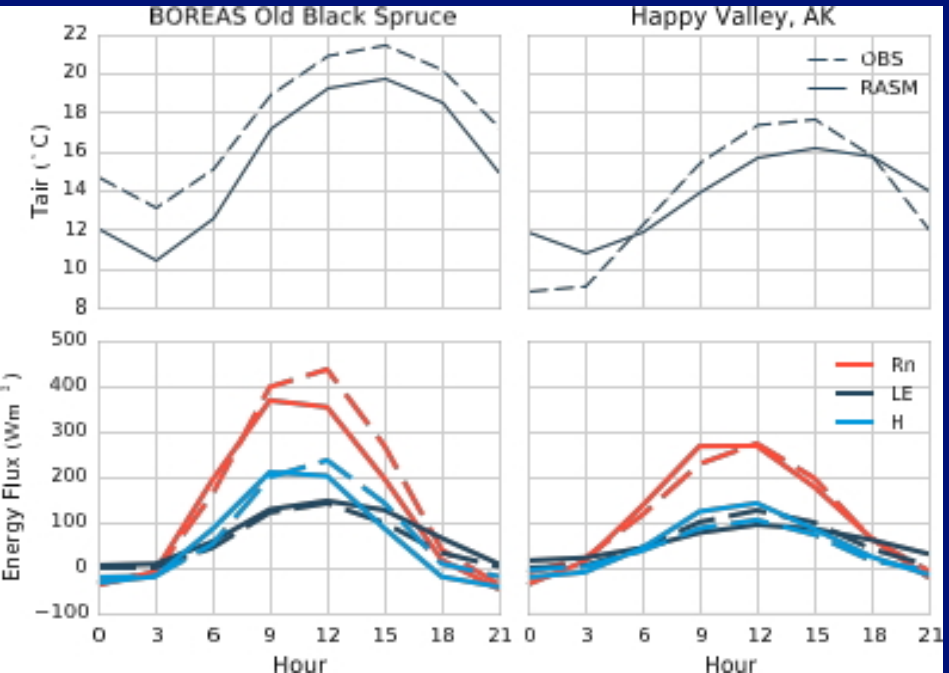
# CORDEX – Scientific Challenges

## ✧ Coordination of regional coupled modelling

Ruti et al., 2016: MED-CORDEX initiative for Mediterranean climate studies. *Bulletin of the American Meteorological Society*, **97,** 1187-1208.




Cyclone Frequency ➔



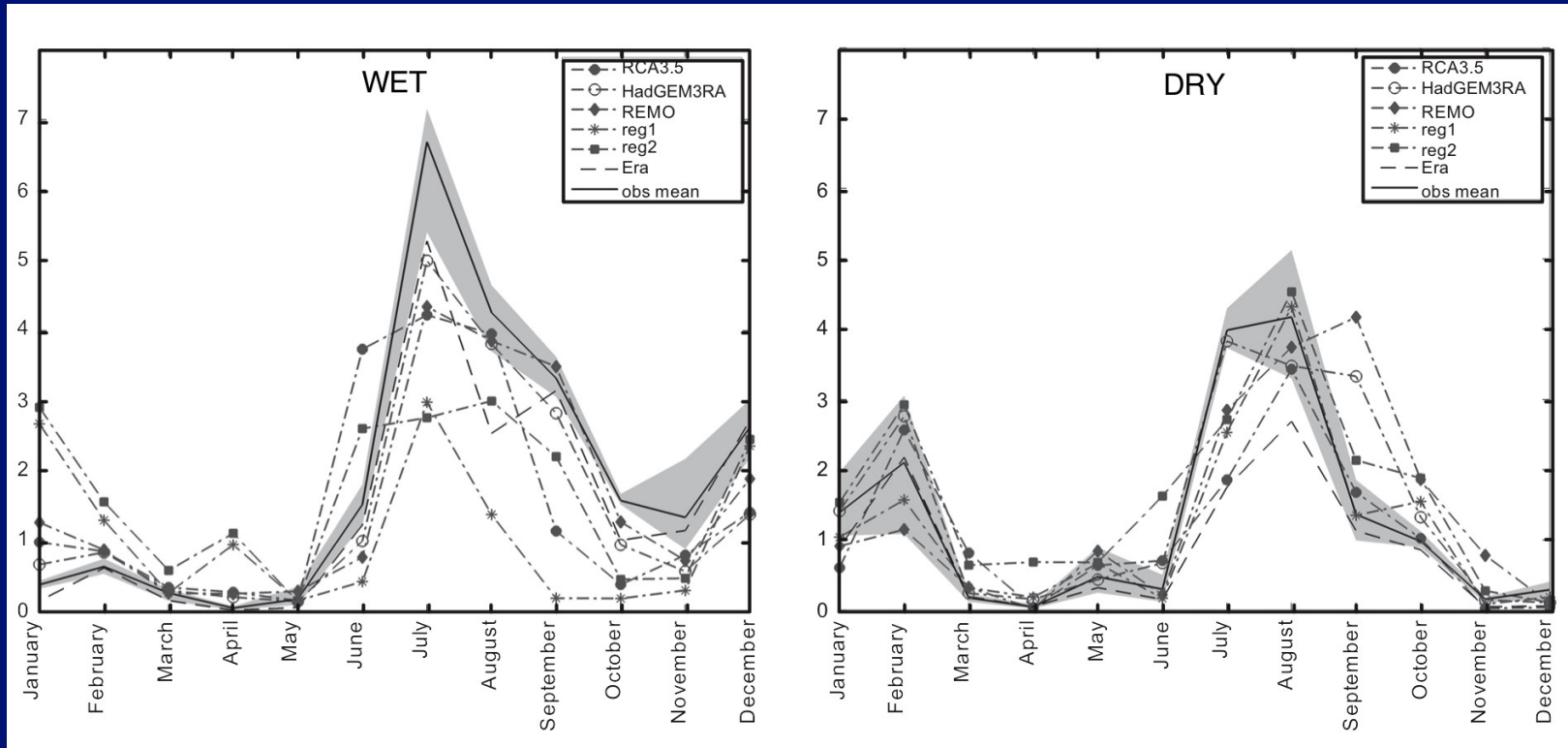

Hamman, J., et al., 2016: Land surface climate in the Regional Arctic System Model. *J. Climate,* **29,** 6543-6562, doi:10.1175/JCLI-D-15-0415.1.

➔ July 1994 & 1995 diurnal cycle

# CORDEX – Scientific Challenges

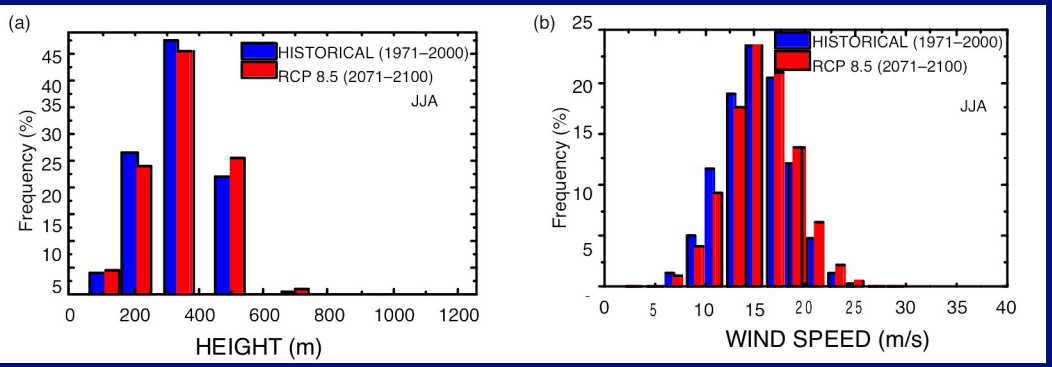
## ✧ Precipitation

Cerezo-Mota, R., et al. (2016): CORDEX-NA: factors inducing dry/wet years on the North American monsoon region. Int. J. Climatol. Article first published online: 5 JUN 2015. DOI: 10.1002/joc.4385.



# CORDEX – Scientific Challenges

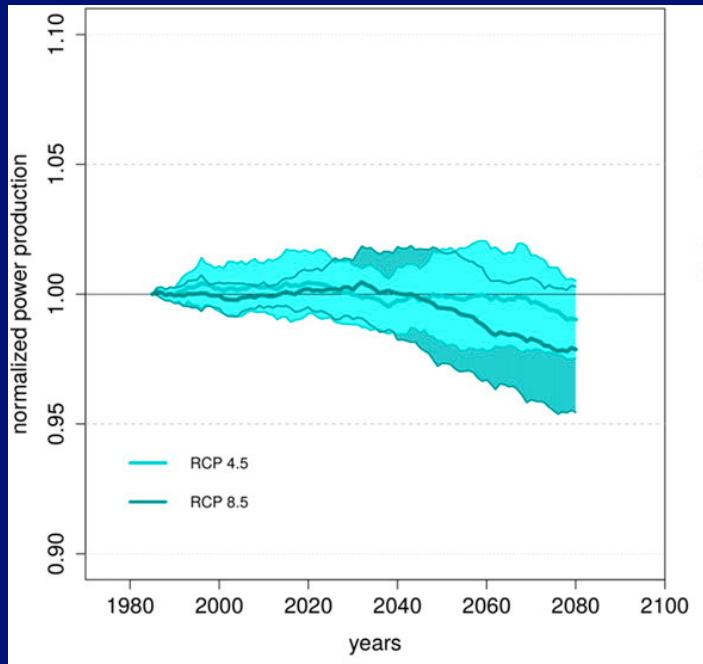
## ✧ Local wind systems




Cardoso, R.M., et al. (2016), A. The impact of climate change on the Iberian low-level wind jet: EURO-CORDEX regional climate simulation (2016) Tellus, Series A: Dynamic Meteorology and Oceanography, 68, art. no. 29005.

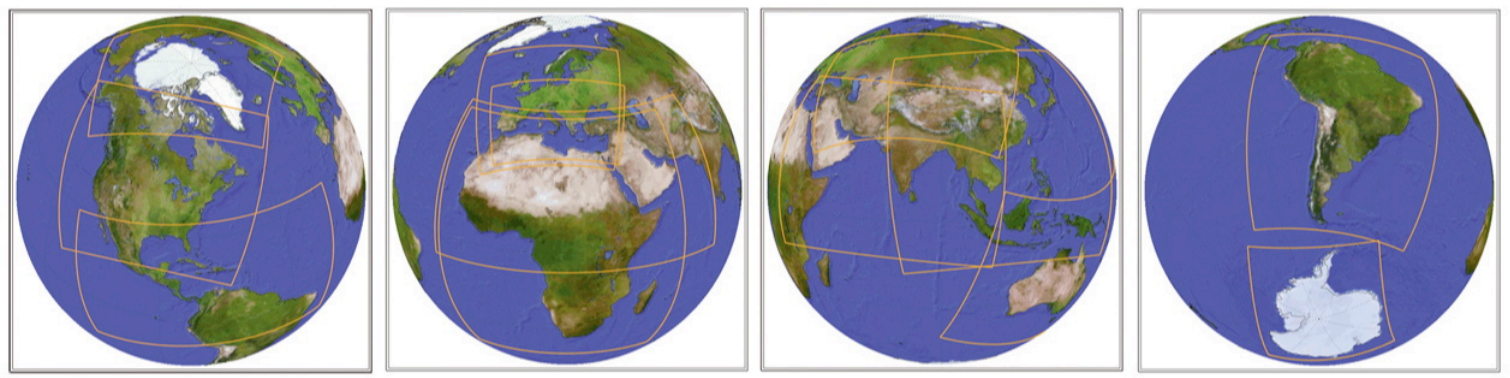
Tobin, I., et al. (2016)., Climate change impacts on the power generation potential of a European mid-century wind farms scenario, Environmental Research Letters, 11, 034013, doi: 10.1088/1748-9326/11/3/034013, 21016.

Based on 2050 wind turbine deployment ➔



# Flagship Pilot Studies (FPS)

- Coordinate developments in conv.-permitting climate sim.
- Should have strong basis in
  - Fine-scale processes important to region's climate (physical basis)
  - Observational basis for verification (analysis basis)
  - User applications (VIA basis)
- Potential connection with other WCRP programs, esp. GEWEX
- First FPS call closed 15 Feb. 2016
- 9 proposals reviewed from 6 CORDEX regions
- Details: www.cordex.org



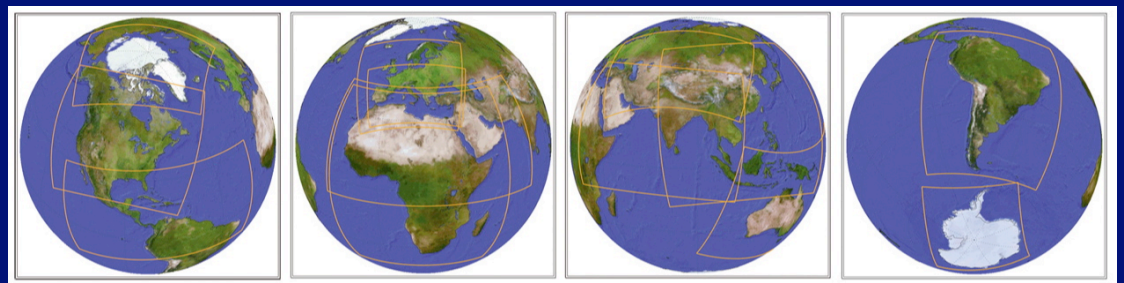
# Flagship Pilot Studies (FPS)

Five now established:

- ✓ EUR+MED: High resolution convective phenomena
- ✓ EUR: Impact of land use changes
- ✓ S. AM: Extreme precipitation events.
- ✓ MED: Role of natural and anthropogenic aerosols
- ✓ MED: Role of air-sea coupling and small-scale ocean processes

Three we will work with further.

More recent round of FPS proposals under review.



# CORDEX Statistical and Dynamical Downscaling: Workshop Series

- Advancing each for climate information
- Coordinating comparison of methods:  advantages of each?
- Exploration of hybrid approaches

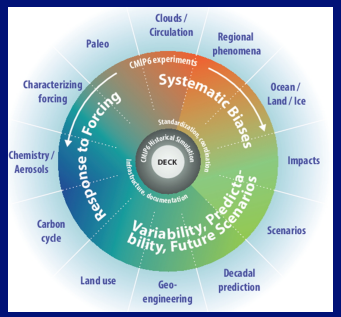
# CORDEX – A CMIP6 Diagnostic MIP

**Primary CMIP6 Question Addressed:**
How can we assess future climate changes given climate variability, predictability and uncertainties in scenarios?

**Primary WCRP Grand Challenges Addressed:**
1. Weather and climate extremes
2. Regional climate information (status?)

**Coordination:** ScenarioMIP, HighResMIP, VIACS AB, . . .

Gutowski et al., 2016: WCRP Coordinated Regional Downscaling Experiment (CORDEX): A Diagnostic MIP for CMIP6. *Geoscientific Model Development* [doi:10.5194/gmd-9-4087-2016]



# CORDEX – IPCC Interest

## CORDEX Coordinated Output for Regional Evaluations (CORDEX CORE)

- In development
- Motivated by
  - IPCC Workshop on Regional Climate (Sept. 2015)
  - WCRP Scoping Workshop on a framework for reg. studies (Oct. 2016)
- Elements
  - Succinct set of downscalings for each region
  - Provide a core foundation for additional work by others
  - Span plausible range of climate change => 3 distinct GCMs?
  - CMIP5? CMIP6? Historical + RCP8.5?
  - Downscaling: 3-4 RCMs? ESD methods?
  - Resolution?

# CORDEX – Opportunities & Challenges

SPARC - tropical convection

- high latitude storm tracks

- Arctic tropopause?

GEWEX - subdaily precipitation

Issues

- progress very uneven across the regions
- linking the region's CORDEX activities with other programs



WCRP CORDEX

# Thank You!